US Army Corps
of Engineers
St. Paul District

Red River of the North
at
Grand Forks, ND & East Grand Forks, MN

Riverside Dam

Michael Lesher
Hydraulic Engineer
U.S. Army Corps of Engineers
St. Paul District

US Army Corps of Engineers
St. Paul District

Riverside Dam

Presentation Summary

- ✔ Project Location & Background
- ✔ Existing Dam & Erosion Problem
- ✔ Hydraulic Design
- ✔ Construction Drawings
- ✔ Completed Project & Construction Photos - Midtown Dam, Fargo, ND
- ✔ Riverside Dam Construction Photos

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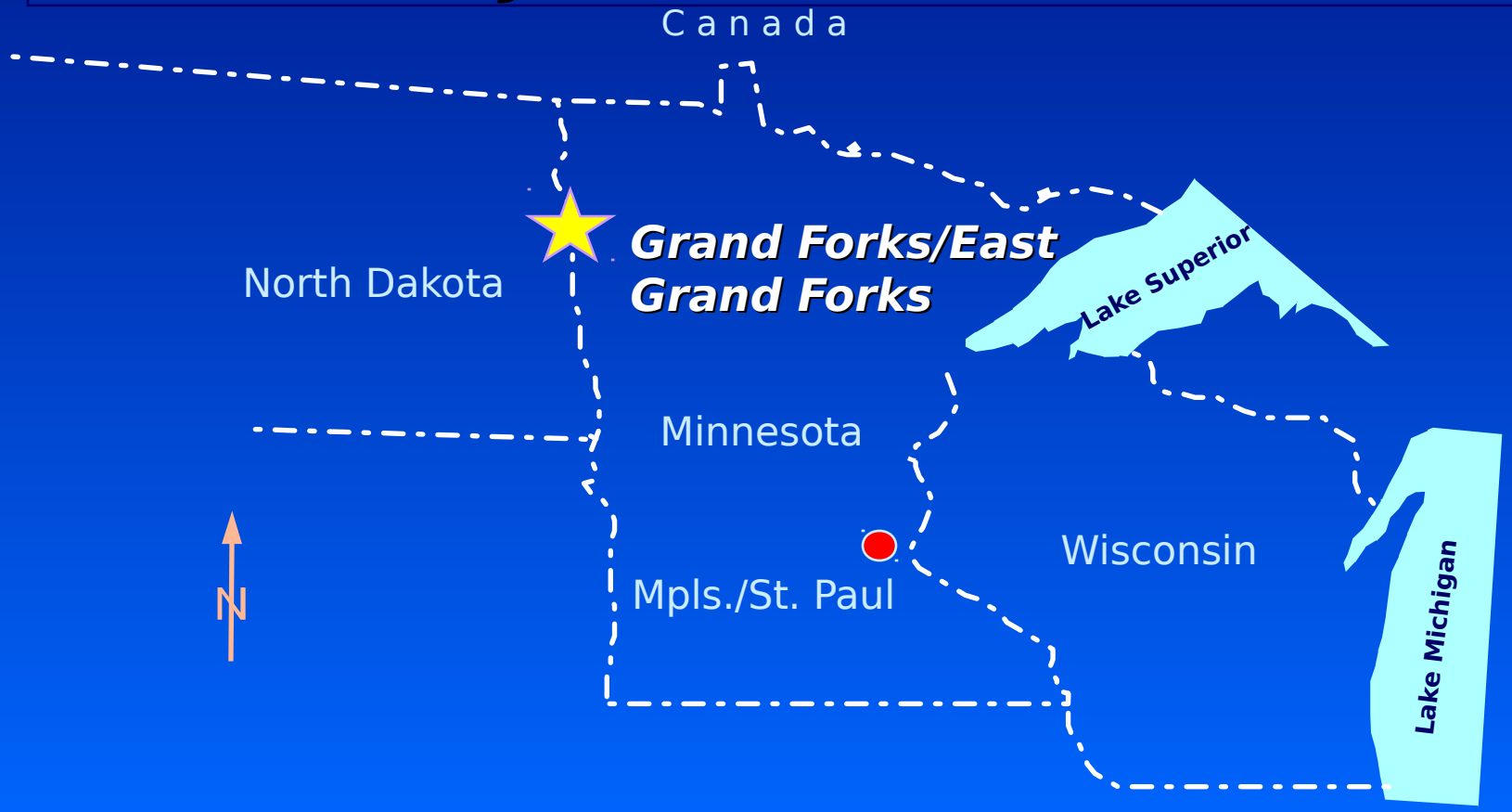
Project Location



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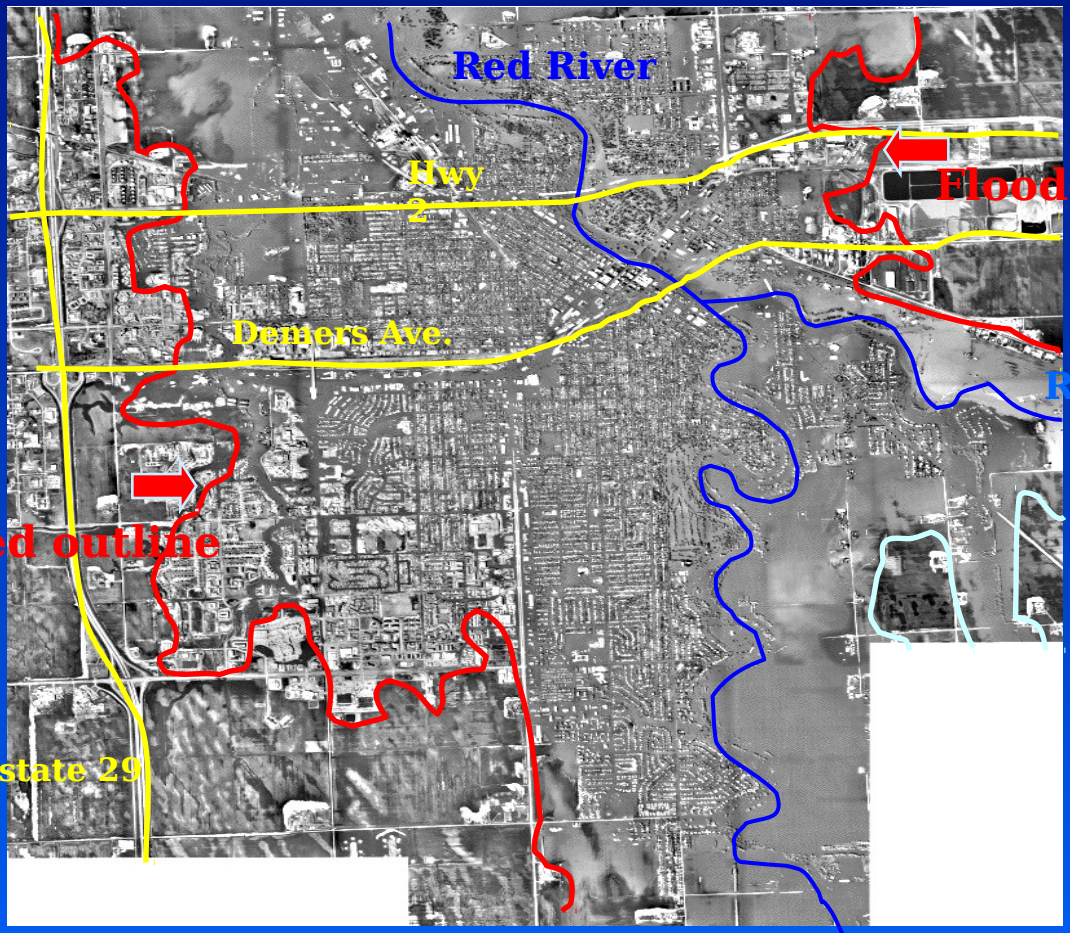

Grand Forks & East Grand Forks Flood of 1997

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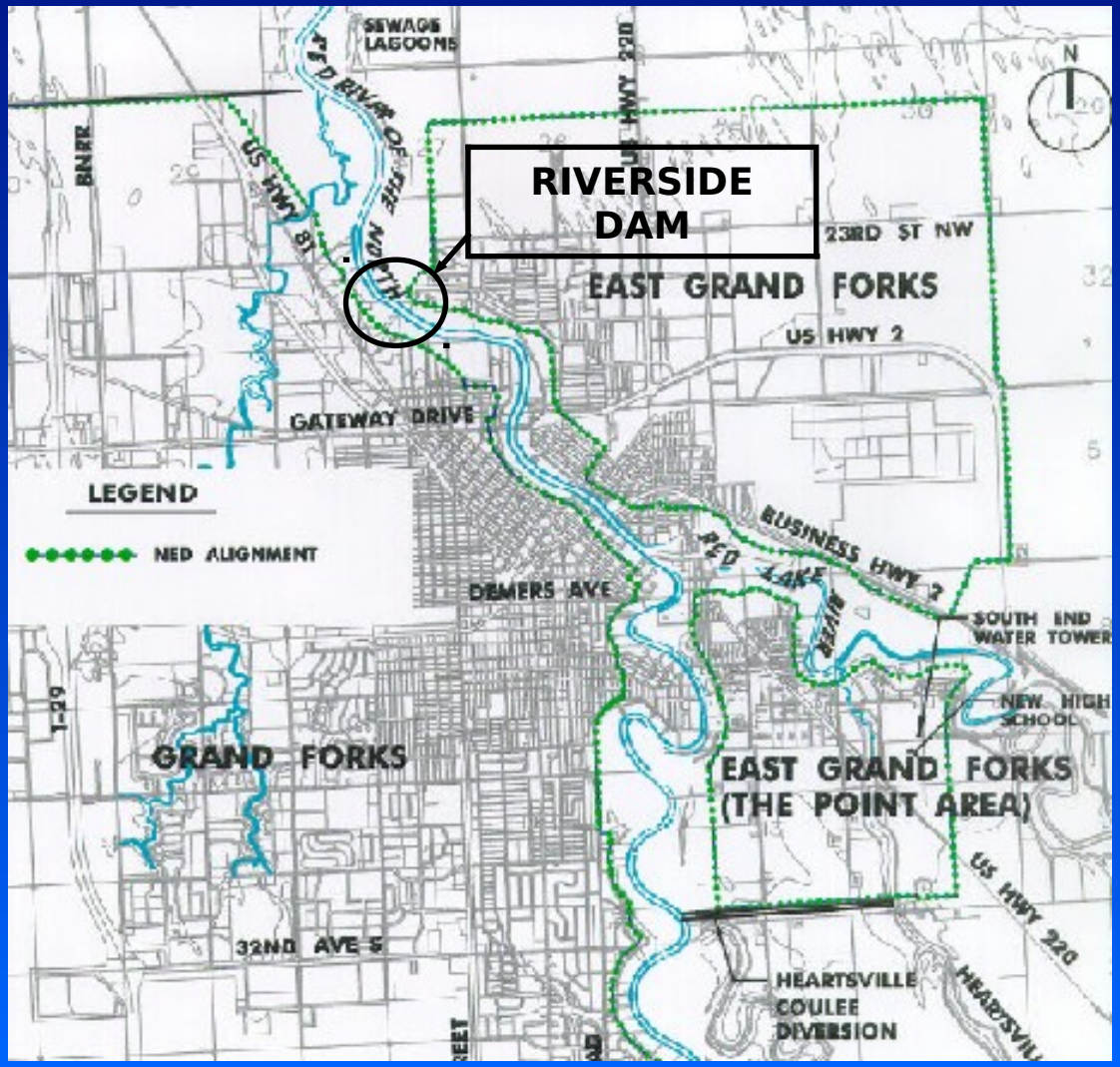

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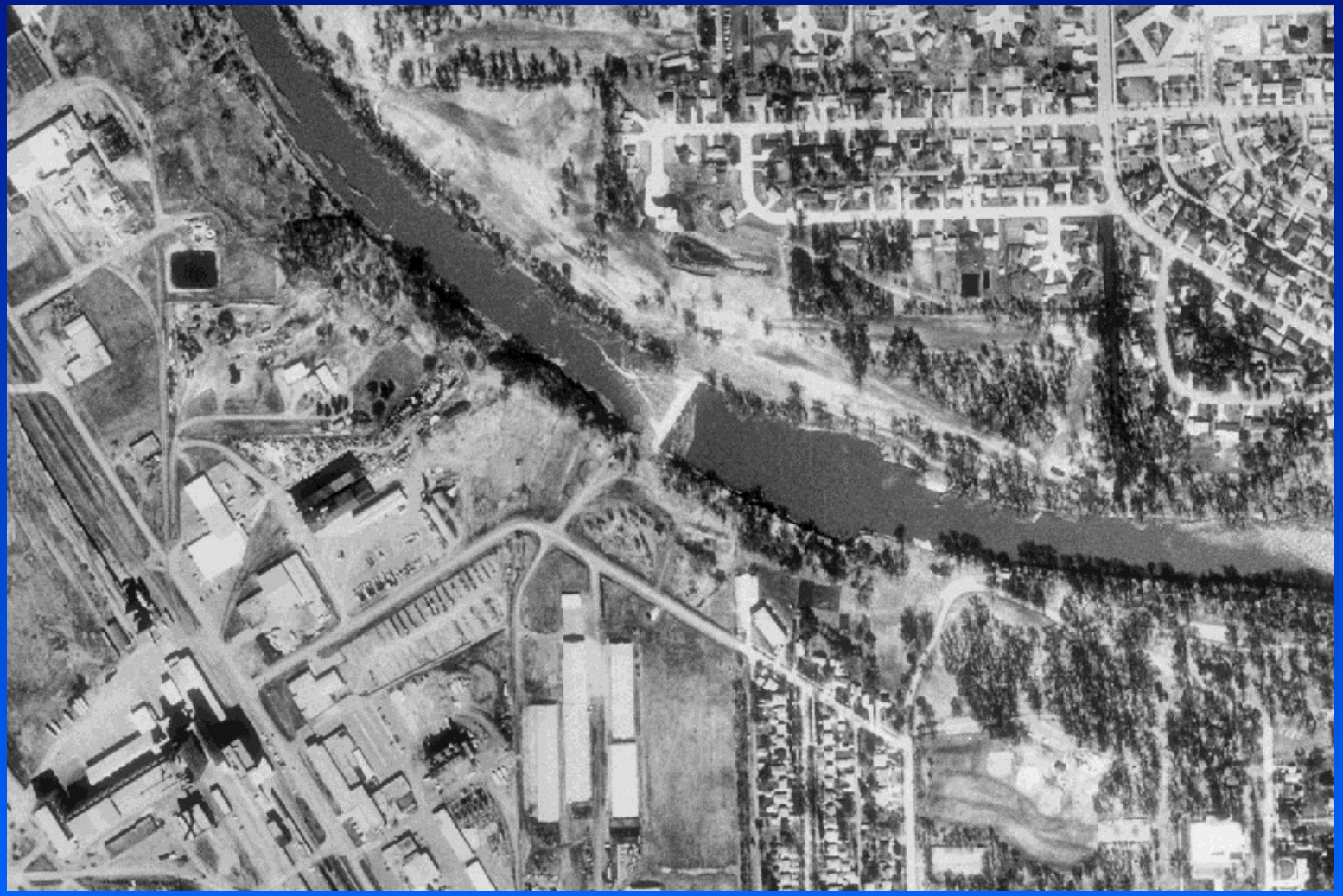

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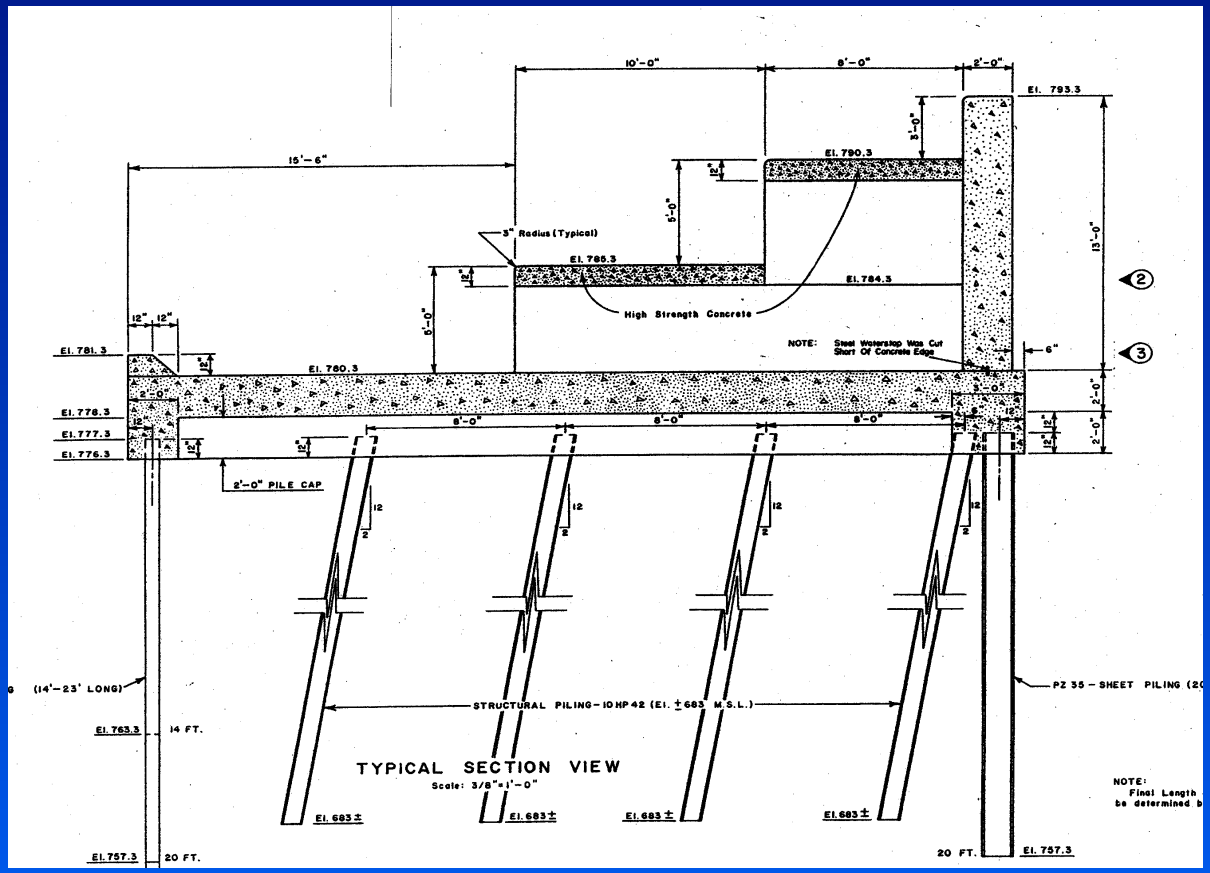

Section of Existing Dam

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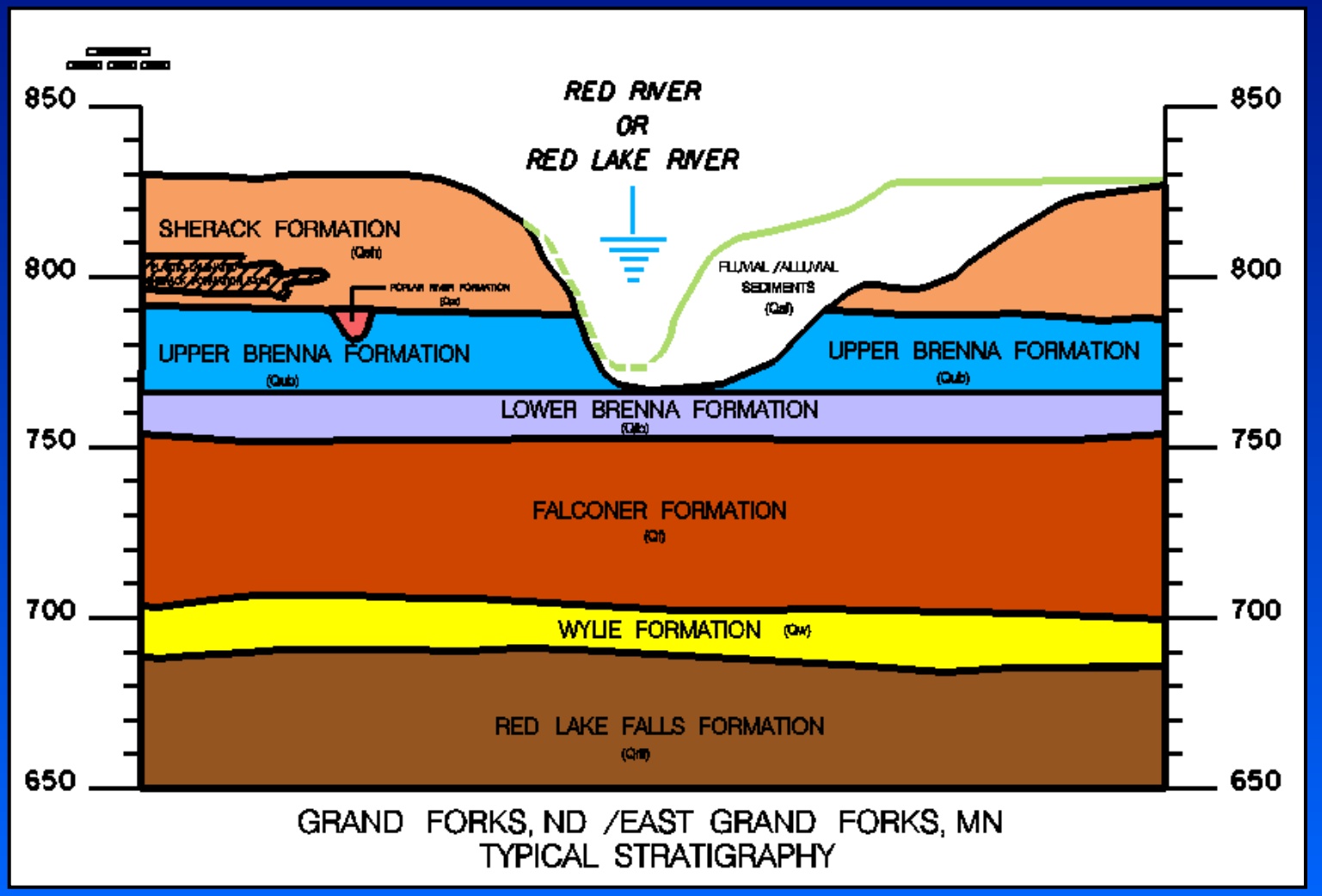

GRAND FORKS, ND /EAST GRAND FORKS, MN
TYPICAL STRATIGRAPHY

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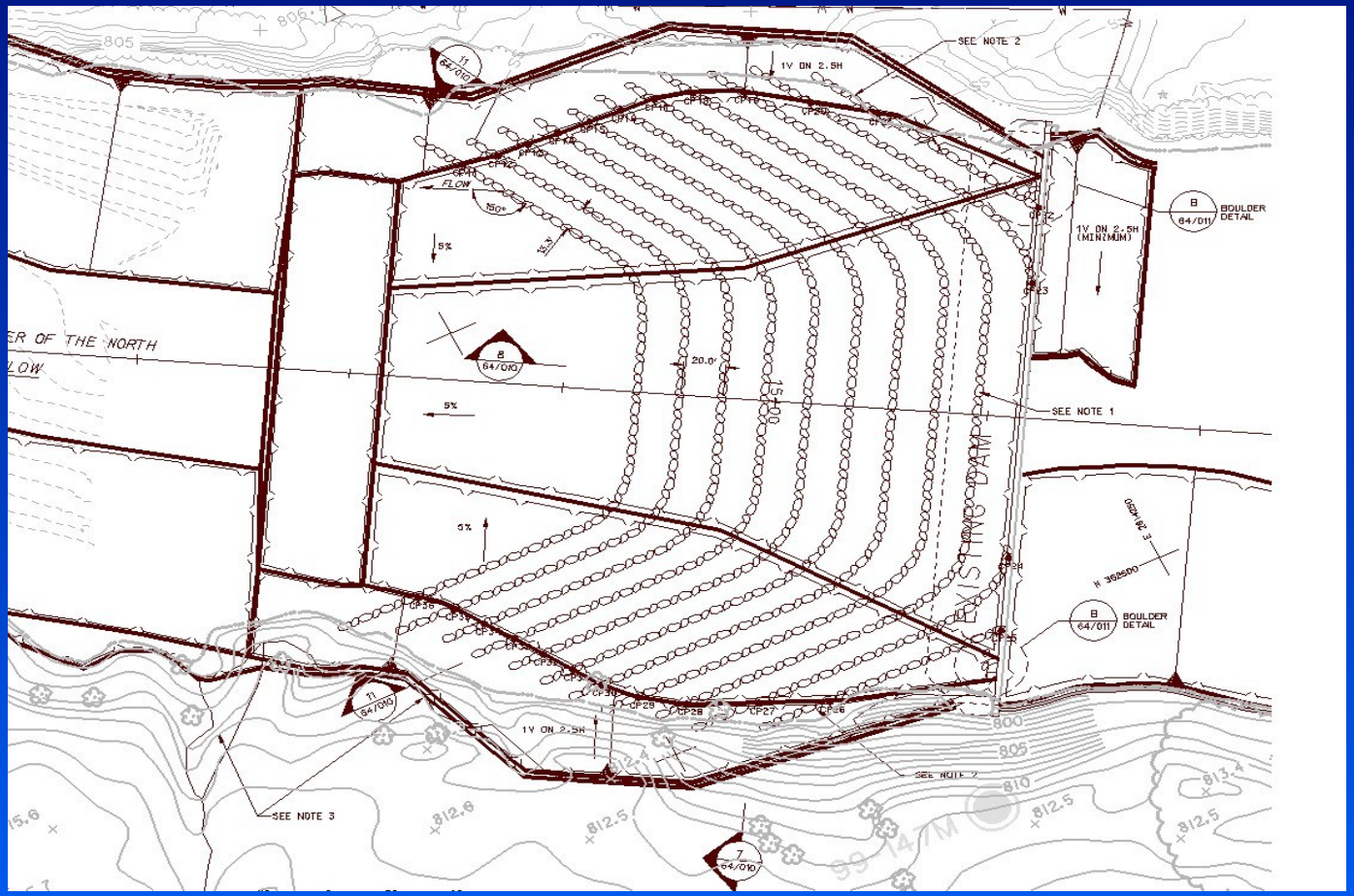

Plan View of Fish Passage Structure

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Hydraulic Design Criteria Sheet 712-1 High Turbulence					EM 1110-2-1601 Steep Slope Riprap Design, Eq. 3-5 $D_{30} = (1.95 * S^{0.555} * q^{2/3})/g^{1/3}$	
Discharge in cfs	Maximum Velocity in fps	D_{50} Minimum based on 712-1 High Turbulence	W_{50} Minimum based on 712-1 High Turbulence	Flow Conditions through Fish Passage Structure assuming 5% Slope (CONSERVATIVE ASSUMPTION THAT DOES NOT INCLUDE AFFECT OF BOULDERS ON FLOW)	q in cfs/ft	D_{30} in feet
1,000	5.4	0.37	4	Supercritical with hydraulic jump	3.25	0.26
2,000	6.9	0.61	20	Supercritical with hydraulic jump	6.49	0.4
3,000	8.2	0.86	55	Supercritical with hydraulic jump	9.74	0.53
4,000	9.1	1.06	103	Supercritical with hydraulic jump	12.99	0.64
5,000	9.9	1.25	169	Supercritical with hydraulic jump	16.23	0.75
6,000	10.6	1.44	258	Supercritical with hydraulic jump	19.48	0.84
7,000	11.1	1.58	341	Supercritical with hydraulic jump	22.73	0.93
8,000	7.7			Subcritical throughout		
9,000	5.9			Subcritical throughout		
10,000	5.1			Subcritical throughout		

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Selected Riprap Gradation based on W_{50} Minimum in Previous Table

D_{30}(min) of Gradation = 1.22 feet

Percent Lighter by Weight	Limits of Stone Weight in pounds		Diameter based on Limits of Stone Weight and a spherical shape	
	Maximum	Minimum	Maximum	Minimum
100	1350	550	2.50	1.85
50	570	270	1.88	1.46
15	260	85	1.44	0.99
5	220	50	1.37	0.83

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Boulders

- Sizes based on Input from Luther Aadland, Mn DNR, and
- Maximum Velocity & Isolated Cube Overturning

3’ - 2,300 lbs

4’ - 5,500 lbs

5’ - 10,800 lbs

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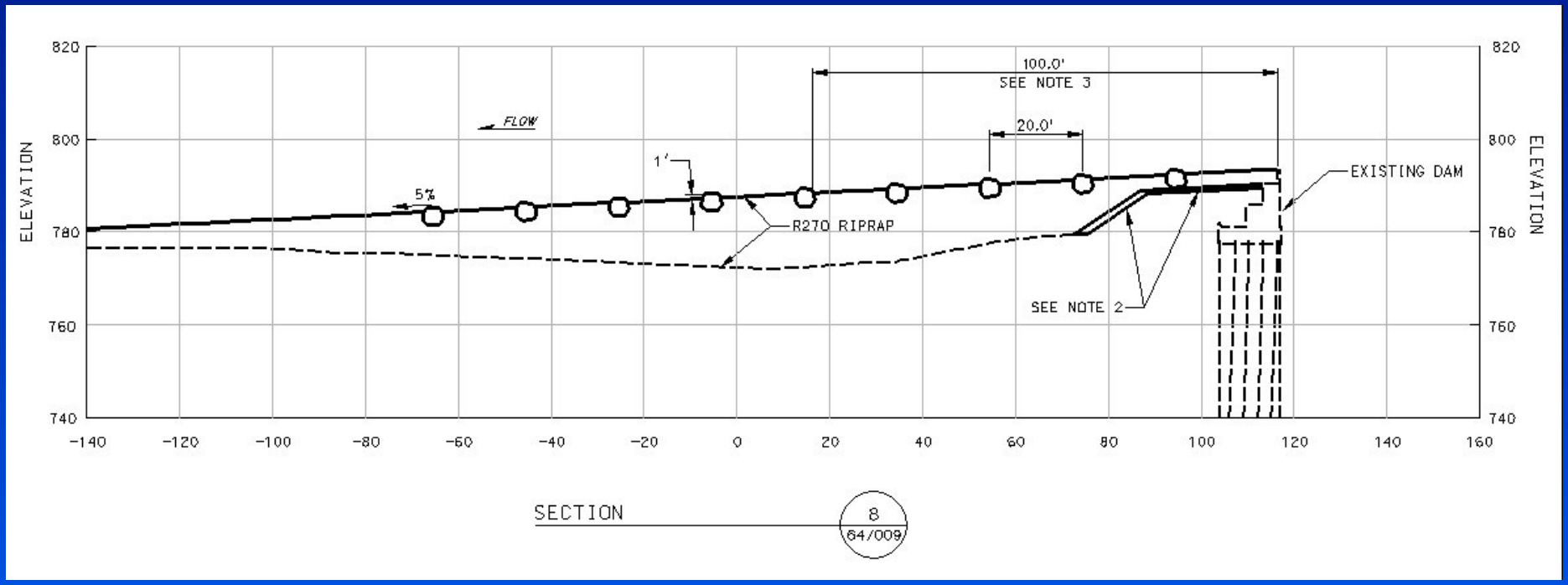

Section along Channel Centerline

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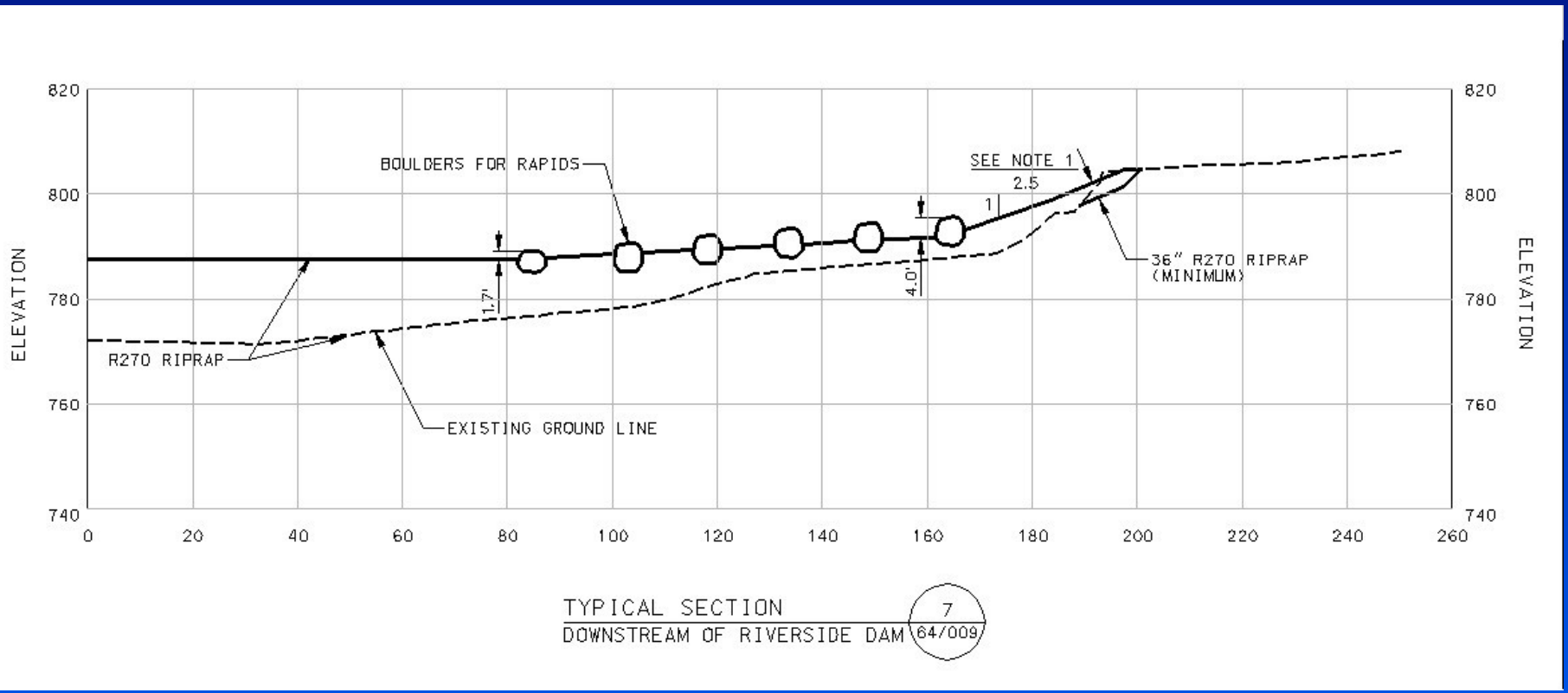

Half Section perpendicular to Channel Centerline

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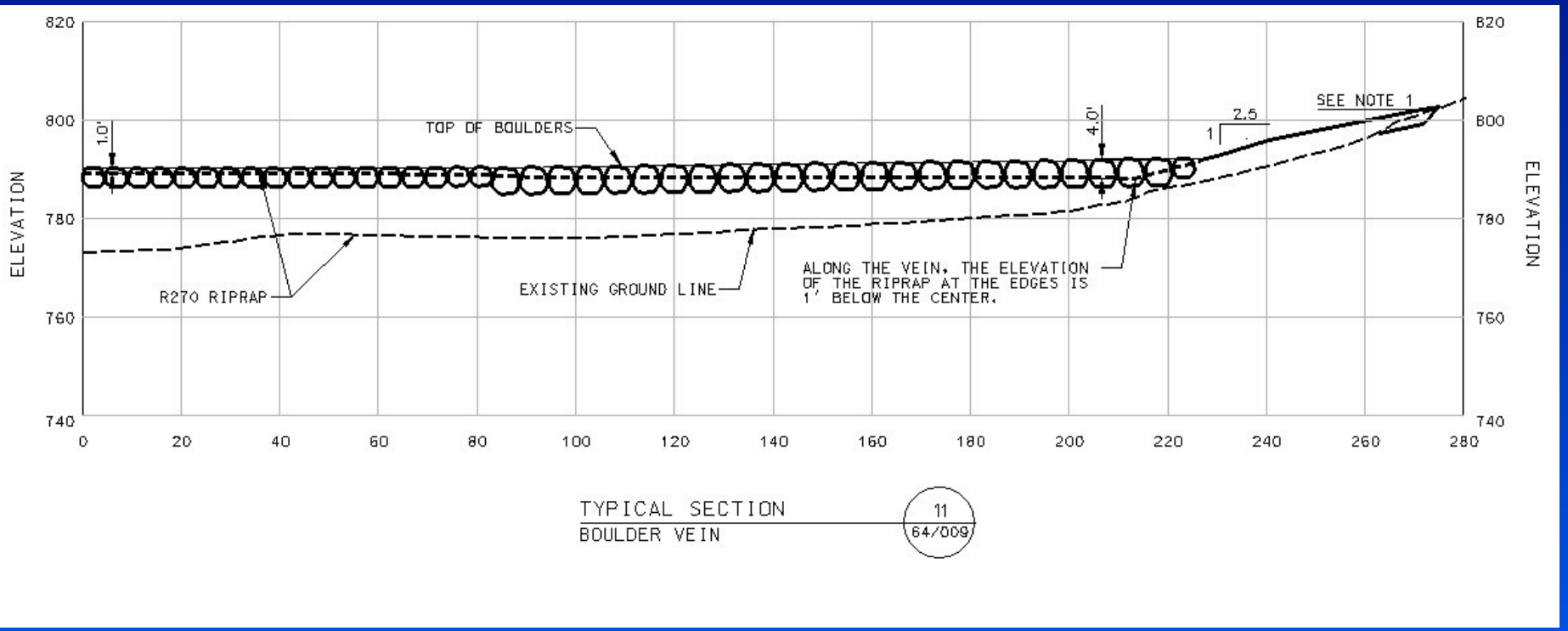

Half Section along Boulder Vein

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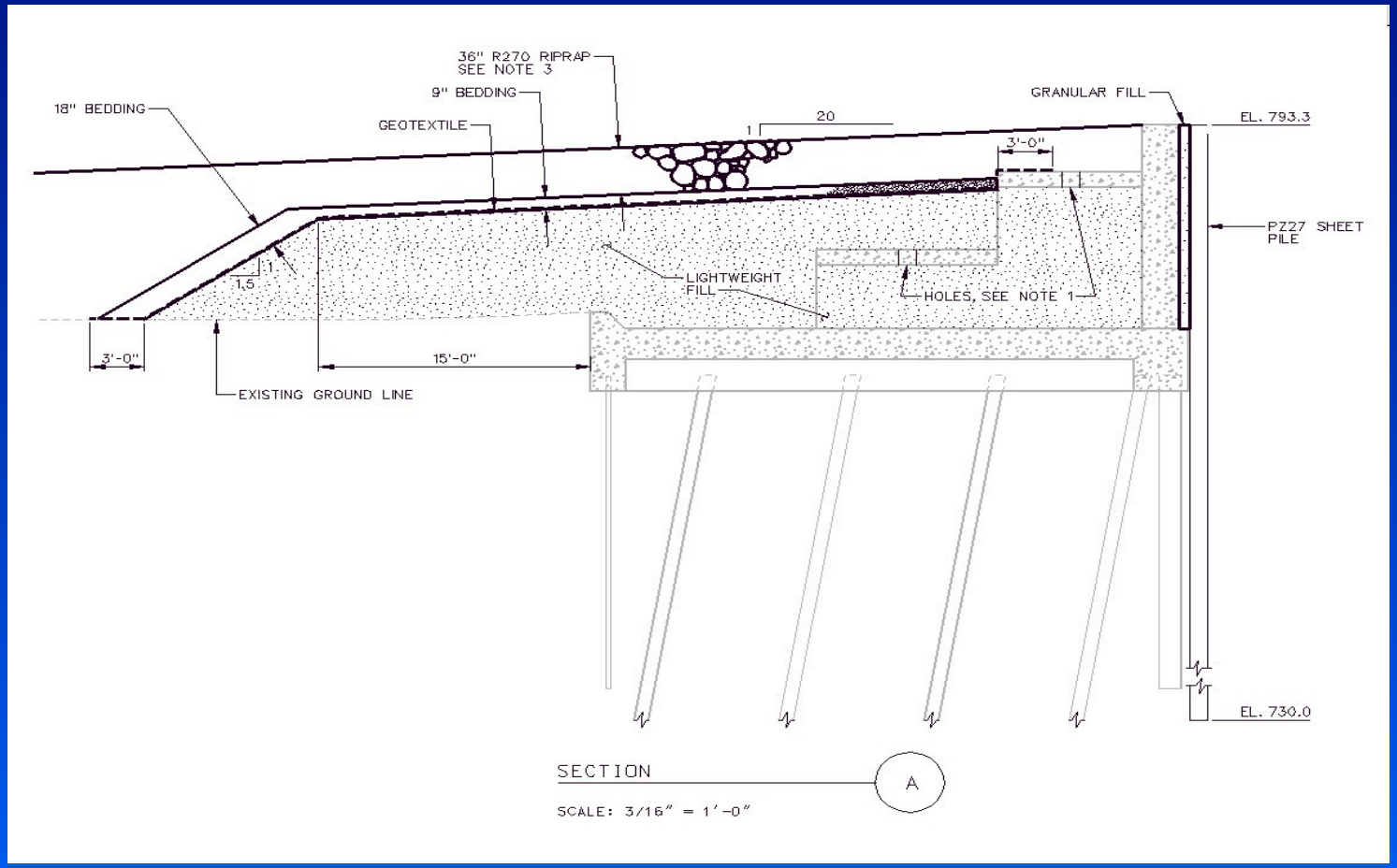

Section along Channel Centerline - Lightweight Fill & Sheetpile

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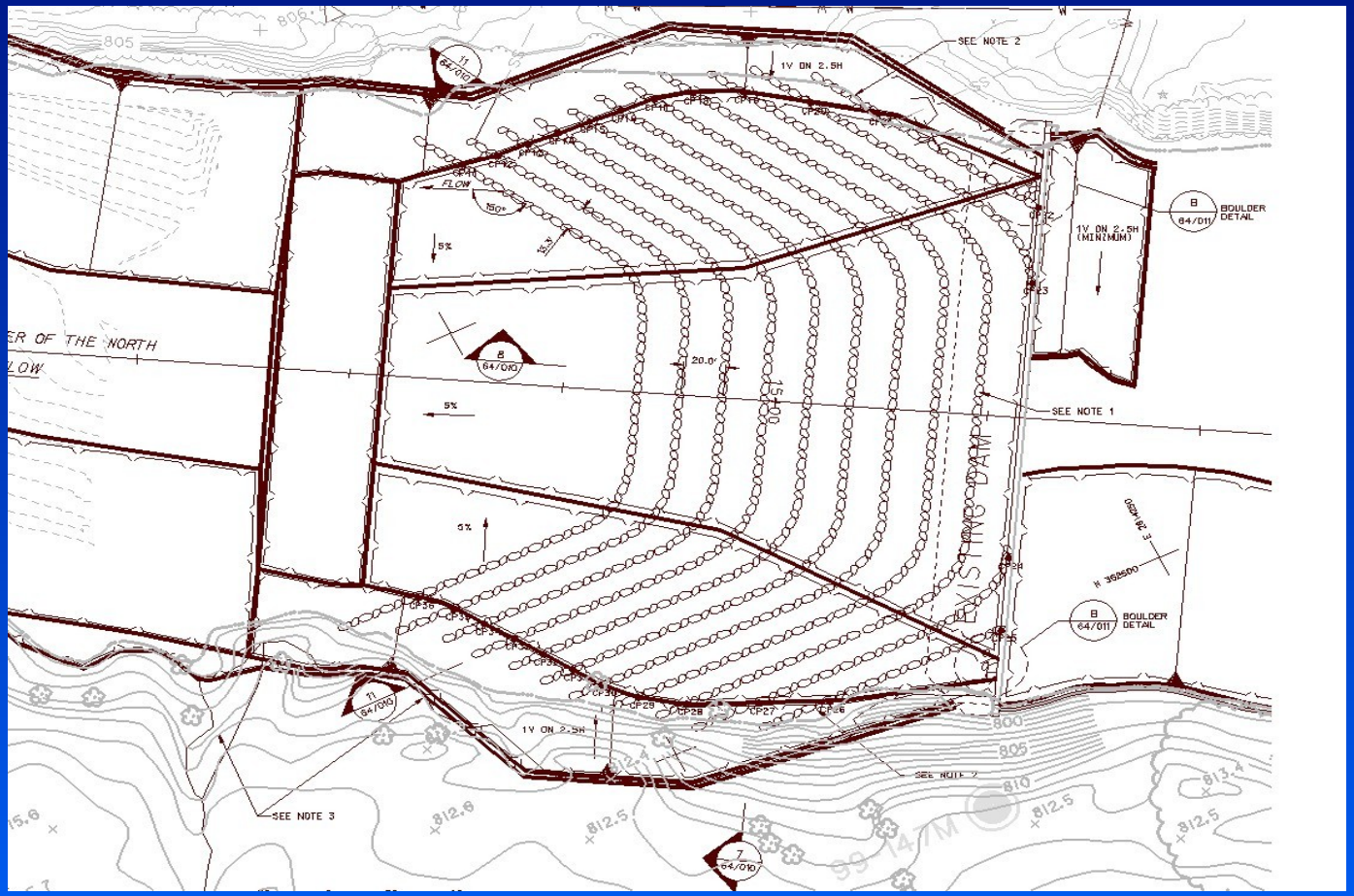

Plan View of Fish Passage Structure

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Midtown Dam, Fargo, ND

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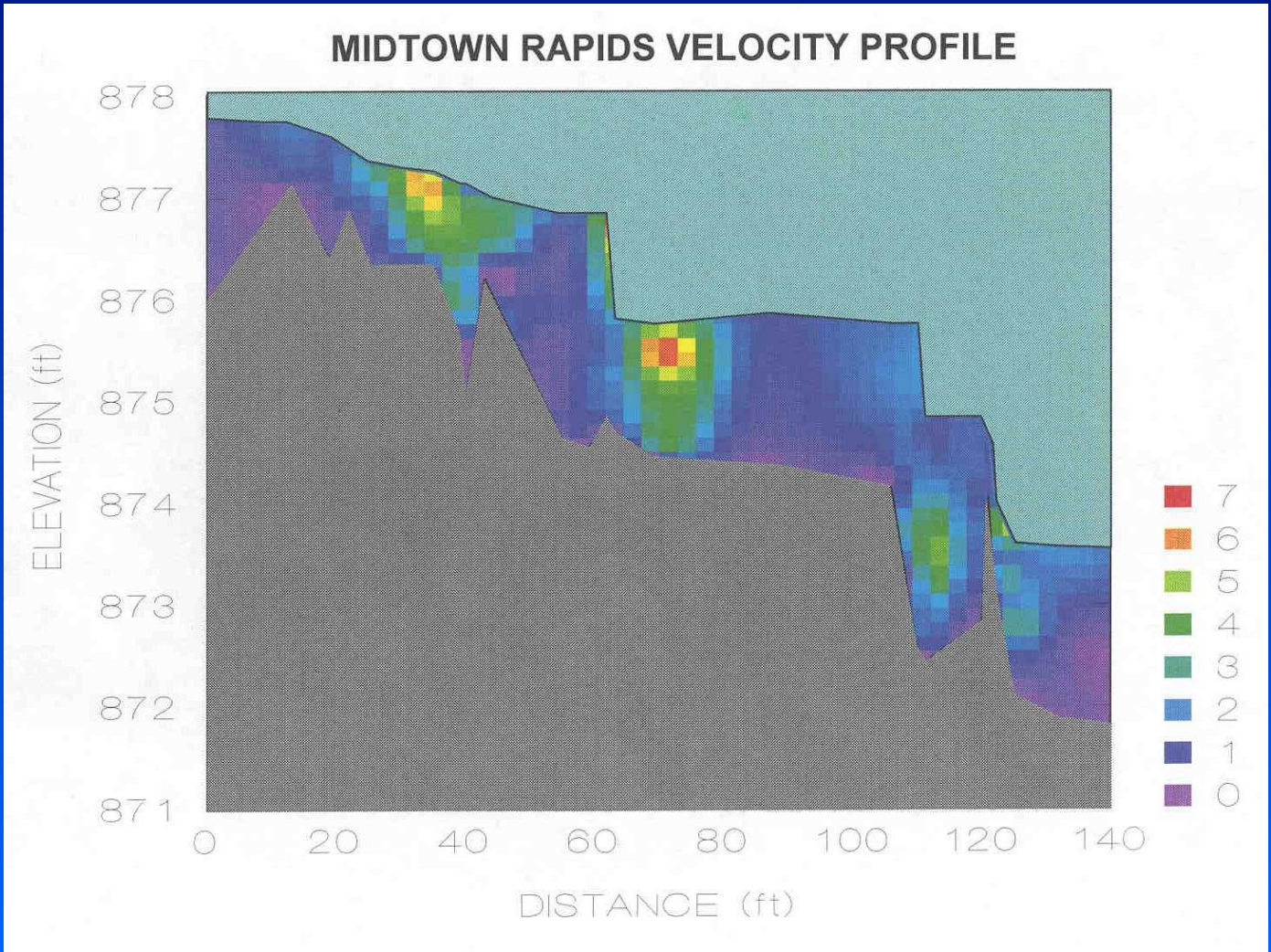

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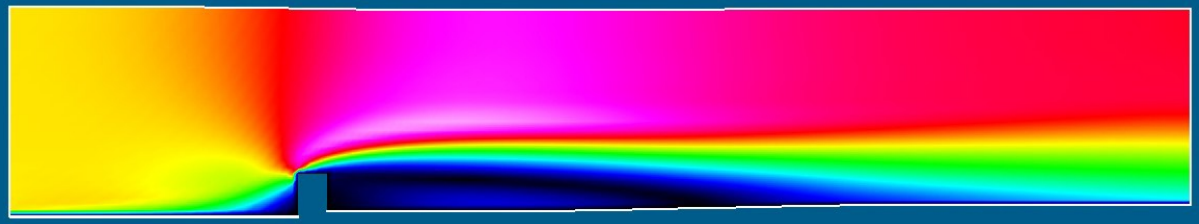
Midtown Dam, Fargo, ND 3-D Modeling

Figure 3

EXISTING GEOMETRY



VELOCITY

0.0 5.0 10.0

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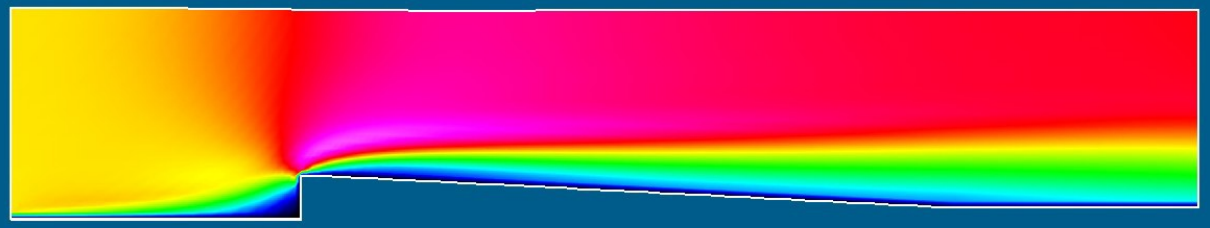
Midtown Dam, Fargo, ND 3-D Modeling

Figure 4

PROPOSED GEOMETRY



VELOCITY

0.0 5.0 10.0

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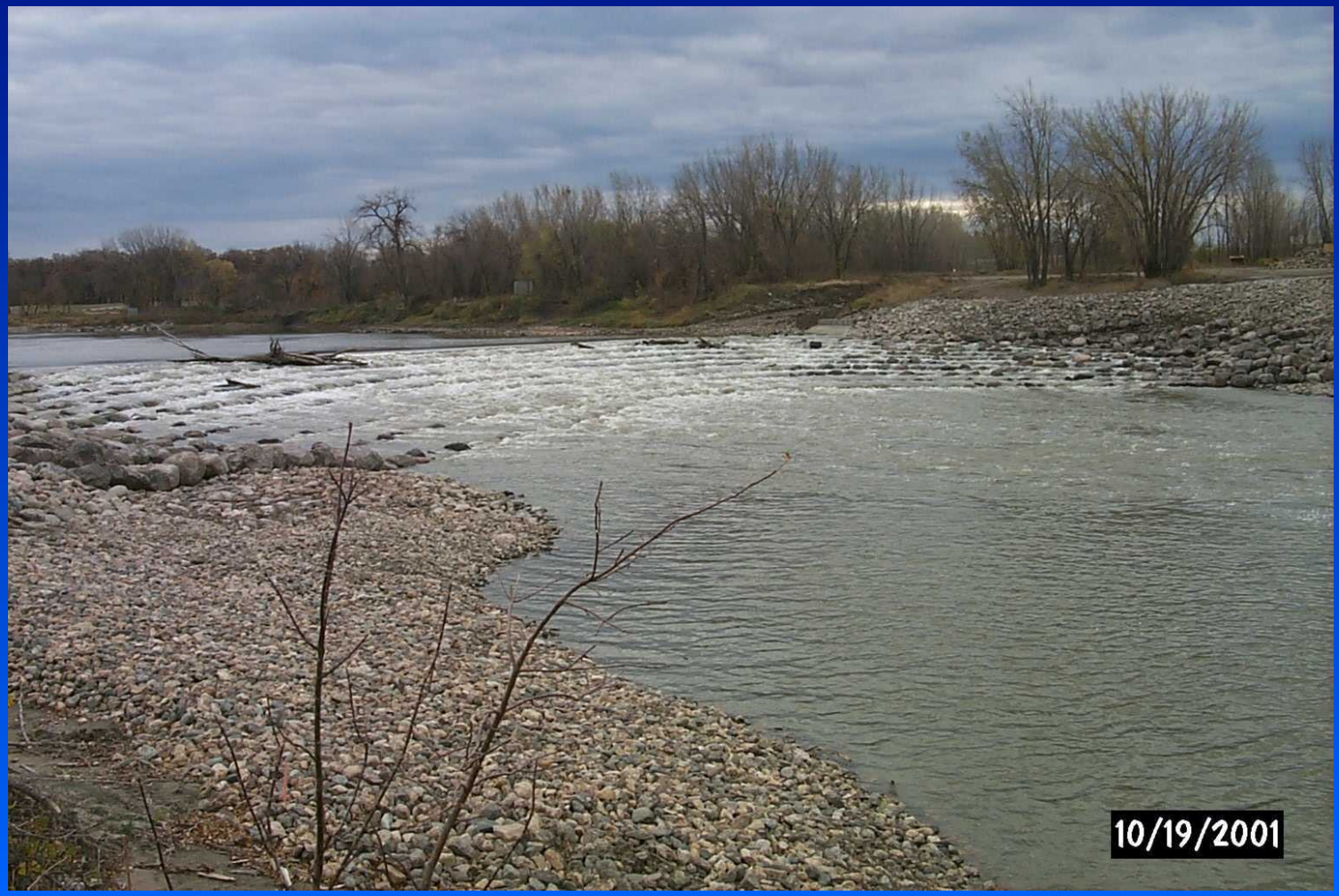

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Before

After

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Questions

Comments